

Serial No. 10/506,789
Amendment Dated: August 14, 2006
Reply to Office Action Mailed: May 14, 2006
Attorney Docket No. 038665.55259US

Amendments to the Drawings:

The attached sheet of drawings includes changes to Fig. 1. In Figure 1, the reference number 14 has been inserted as required.

Attachment: Replacement Sheet

REMARKS

Applicants acknowledge the indication of the allowability of the subject matter of Claims 9 and 10 as set forth under the heading "Allowable Subject Matter" at page 8 of the Office Action. In particular, Claims 9 and 10 would be allowable if rewritten in independent form. Nevertheless, for the reasons set forth hereinafter, Applicants respectfully submit that Claims 9 and 10 are allowable in their present dependent form.

The drawings have been objected to on the ground that they contain an element 68 which is not mentioned in the description. In response to this ground of objection, Applicants have amended the specification at page 7, line 18 to correct a typographic error, changing the reference numeral "66" to "68".

In addition, the drawings have been further objected to for failing to show the reference numeral 14, referred to in the specification at page 3, line 29, and other locations. In response to this ground of objection, Applicants have submitted herewith a replacement sheet which includes a new version of Figure 1 into which the reference numeral 14 has been inserted, with a lead line to one of the hollow corner cubes, as discussed in the specification. Accordingly, Applicants respectfully request that these grounds of objection to the drawings be reconsidered and withdrawn.

In response to the objection to the Abstract of the Disclosure, an amended abstract has been submitted, attached hereto on a separate sheet as required.

Finally, the specification has been objected to, and Claims 3-7 have been rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement, based on the Examiner's observation that it is unclear where the quantity "N" is introduced, and how to use it.

In response to the latter grounds of objection and rejection, Applicants note that the specification explains the quantity "N" at page 3, lines 20-27. In particular, N represents the surface emissivity of an object, expressed as a percentage. (That is, emissivity is expressed as N%.) This use is consistent with the dictionary definition of emissivity, which according to *Webster's Ninth New Collegiate Dictionary* is: "the ratio of the radiant energy emitted by a surface to that emitted by a blackbody at the same temperature". Thus, the specification states that a simple plane surface that exhibits N% emissivity reflects surrounding hot metal work at 100-N%. A person skilled in the art would easily understand that the expression "N%" as used in Claim 3 represents the percentage emissivity of a reflective surface, based on the commonly understood meaning of that term. Accordingly, Applicants respectfully submit that this recitation in Claim 3 is fully and adequately described in the specification at page 3, lines 20-27, which show that the inventors had possession of the invention at the time when the application was filed.

Claims 1 and 2 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Kato et al (U.S. Patent No. 5,602,389) in view of Kaufman et al (U.S. Patent No. 6,476,392) and further in view of Smith (U.S. Patent No. 4,933,555). In addition, Claim 8 has been rejected over Kato et al in view of Karlsson et al (U.S. Patent No. 5,572,312), while Claim 11 has been rejected as unpatentable over Kato et al in view of Karlsson et al and further in view of Kaufman et al. However, for the reasons set forth hereinafter, Applicants respectfully submit that all claims of record in this application distinguish over the cited references, whether considered separately or in combination.

The present invention is directed to a method and apparatus for calibrating a camera which employs cryogenically cooled detector elements. As noted in the specification at page 1, line 6-10, such cameras typically employ a plurality of detector elements arranged in a focal plane array (FPA) on which an image is focused.

According to the invention, an infrared detector calibration system comprises a reference surface which is made up of a plurality of hollow corner cubes that are partially reflective and partially emissive. Temperature controlling means are provided in order to maintain the reference surface at a desired calibration temperature, as well as processing means for receiving an output signal generated by the infrared detector at the desired calibration temperature, comparing the detector output signal with a predetermined ideal

output signal for the desired calibration temperature, and calculating a calibration coefficient based on the difference between the detector output signal and the ideal output signal at the desired calibration temperature.

The latter features of the invention are recited in Claim 1. Claim 3 further recites that each corner cube comprises a reflective surface and a matt surface to form an effective emissivity of N%, as explained previously. As recited in Claims 6 and 7, the matt surface may comprise either a matt black paint overlying the reflective surface, or a non-reflective surface etched into the reflective surface.

The Kato et al patent, on the other hand, discloses an infrared sensor calibration apparatus that uses a reference surface in the form of a blackbody radiation surface that has temperature controlling means adapted to maintain the surfaces of the apparatus at the respective predetermined temperatures. Moreover, the apparatus also includes a data processor which is supplied with the output value of the infrared sensor, as well as with the temperatures of the blackbody and cylindrical cover member, to calculate the intensity of the infrared rays incident upon the apparatus, based on the temperature's emissivity of the blackbody and cylindrical cover member. However, Kato et al fails to teach or suggest the use of a plurality of hollow corner cubes, which are partially reflective and partially emissive, such as recited, for example, in Claim 1. Furthermore, insofar as Applicants have been able to determine, this patent also

does not provide a predetermined ideal output signal. Rather, it provides a relative ideal output signal to calibrate the detector.

The Kaufman et al reference, on the other hand, discloses a temperature dependent focal plane array that operates without a temperature stabilization cooler or heater. Applicants respectfully submit that this arrangement would not have been considered by a skilled person who is attempting to produce an infrared detector calibration system, as it does not in fact calibrate the infrared detector. Rather, it merely compensates for the measured temperature of the apparatus, by calculating a calibration based on a detected temperature of the focal plane array. Accordingly, Applicants respectfully submit that the apparatus is not provided with a reference surface, nor does it include a plurality of hollow corner cubes or temperature controlling means. Therefore, it does not comprise processing means for receiving an output signal generated by an infrared detector at the desired calibration temperature or that compares the detector output signal with a predetermined ideal output signal for the desired calibration temperature, and calculates a calibration coefficient on the basis of the difference between the detector output at the signal from the ideal output at the signal at the desired calibration temperature, as recited in Claim 1 of the present application.

The Kaufman patent does not appear to be directly relevant to infrared detector calibration systems, because it does not include or use a reference surface, nor does it attempt to control the temperature of the apparatus.

Finally, the Smith patent discloses a thermal imager which has a cryogenically cooled detector element array that is provided with a retroreflective region on part of a field stop on the edge of the field of view on the optical system. In addition, it also includes a processing portion that receives signals generated by the thermal imager for each element of the thermal imaging apparatus, and calibrates each element in the detector array. Therefore, in contrast with the present invention, the elements of the array are equalized relative to each other, not in comparison with a predetermined ideal output, as disclosed and claimed in the present application.

To summarize, none of the above documents discloses a system that calibrates the elements of an infrared detector using hollow corner cubes that are partially reflective and partially emissive relative to a predetermined output signal (*i.e.*, an absolute value). Rather, the references either do not use hollow corner cubes, or do not calibrate relative to another part of the apparatus or relative to other elements in the array. Thus, a person skilled in the art looking to provide the present invention, and having knowledge of all three of these references, would not perceive an obvious way in which the reach the present

invention, because none of these documents discloses calibrating infrared detectors in such a manner.

In order to replicate the present invention based on the Smith reference, a person skilled in the art would be required to implement the difference of comparing the detector output signal with a predetermined ideal output signal for the desired calibration temperature. The Smith reference would not induce a person skilled in the art to alter either of the other two references, as the result would be seen as less accurate than having a relative temperature comparison. However, the present invention recognizes the provision of a sufficiently cold reference surface to generate the low flux levels equivalent to scenes often encountered in practice requires substantive cooling of the reference surface, which can be expensive, and difficult to achieve. The comparison with a predetermined ideal output signal as disclosed and claimed in the present application, however, does not require such an expensive addition, and therefore produces a more economic apparatus.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

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If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038665.55259US).

Respectfully submitted,



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Attachments - Amended Abstract of the Disclosure
- Replacement Sheet (Figure 1)

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